THE TREATMENT OF BRONCHIAL ASTHMA BY VACCINATION, WITH REPORT OF CASES.

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Until recently Osler has described asthma as "so imperfectly understood that it is impossible to give a satisfactory definition." The pathology included spasm of the bronchi and spasm of the respiratory muscles and diaphragm and vasomotor disturbances of the bronchial mucous membrane. Etiology included heredity, a neurotic basis, and in addition other factors, such as nasal obstruction by polypi and hypertrophied turbinates, climatic effects, and gout.

Measures for cure generally proved useless; to help the individual attacks, adrenalin, morphin, strychnin, atropin, potassium iodide, lobelia, stramonium, and asthma powders have all been extensively used, but no means of preventing future attacks has been found.

Although we must admit that asthma is still imperfectly understood and that its etiology is not always clear, yet the past few years have added much information which will without doubt be a clue to the eventual relief of this harassing malady.

When a foreign proteid is injected in minute quantities into the animal body, sensitization occurs; the injection of a large amount of the same proteid[1] after a certain interval of time (usually twenty-one days) results in a set of symptoms characterized by sneezing, labored breathing, skin eruptions, joint and glandular swellings, edema, and cardiac palpitation; if the attack be severe enough, convulsions and death follow; this reaction is called anaphylaxis. Anaphylaxis implies a hypersensibility; either a natural one exemplified by an attack of hay fever or serum sickness, or an artificial one brought about for example by a previous injection of horse serum.

Animal experimentation[2] has taught us that when the foreign proteid is injected into the body in proper amounts, specific antibodies or amboceptors are produced for this proteid; if after certain periods of time the injections be repeated in constantly increasing quantities, some of these antibodies in the presence of compliment and antigen, are protective; this holds true whether the invading substance be introduced subcutaneously, intravenously, intraperitoneally or by mouth. The foreign proteid contains two substances, one toxic which may cause death, and one which immunizes the individual.[3]

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[1] Rosenau and Anderson: Hygienic Laboratories Bulletin, 1908, Nos. 29 and 45.

[2] Zinsser, H.: Anaphylactic Phenomena. Harvey Lectures, 1914-1915, series No. 10.

Immunization is obtained by introducing this foreign proteid into the system in small quantities frequently repeated and in increasing doses, within seven or eight days each, during the pre-anaphylactic or anti-anaphylactic period; if the period be too long the hypersensitive state may lead to serious or fatal consequences; this hypersensitive state may be transmitted from mother to offspring.

Bacterial anaphylaxis is not so readily produced as that by foreign albumens, as egg and serum albumens.

Food protein is absorbed as amino-acids and then reconverted into protein in the proper form for utilization; if by any chance it undergoes incomplete breaking down, and some of the by-products are absorbed, sensitization occurs; if after a certain time (ten to fourteen days) the same article is again eaten, anaphylaxis results in the form of asthma, urticaria, or erythema (the so-called indigestion rash). This same sequence probably occurs in the case of injected proteids, whether horse serum, bacteria, or pollen; if not converted into a proper and available form for use, their by-products sensitize the individual so that a second dose is anaphylactic.

Asthma is undoubtedly in some cases an expression of anaphylaxis; clinically it resembles the hypersusceptibility produced in animals by the injection of foreign proteid. Patients with this disease become sensitized to some form of proteid by absorption from the nasal mucus membrane, alimentary canal, or from some focus of infection, and react with an attack of bronchial asthma upon an intoxicating dose of the poison (Meltzer). Babcock recalls the case of a sufferer from asthma who was operated upon for gall-stones, with relief of the asthma, and as long as drainage of the gall-bladder was maintained there was no asthma, but with stoppage of drainage it returned; finally, with cure of the gall-bladder the asthma disappeared. Likewise the removal of nasal polyps restores drainage to the accessory sinuses of the nose and relieves a pent-up focus of absorption which has been causing attacks; the removal of hypertrophied turbinates acts in the same way. In some cases the smell of horses or of the stable in a sensitized individual will bring on an attack. Sometimes the injection of horse serum even in the form of antitoxin will produce an attack;[4] a friend of mine who received a small immunizing dose of diphtheria antitoxin had such a severe anaphylactic reaction with asthma that his life was despaired of. Asthmatic attacks occurring with hay fever, and due to the pollen of rag weed, golden rod,[5] etc., are of the same origin; inoculation with constantly increasing emulsions of these pollens, or polyvalent emulsions, will cure or improve the attacks. Egg proteid also causes attacks in some individuals. I have in mind a child who had asthmatic attacks after eating eggs, and which attacks cleared up after a change in diet. The urticaria following the ingestion of fish is of the same character; likewise the urticaria following the injection of antitoxin.

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[3] Vaughan, V. C.: Proteid Split Products in Immunity and Disease.

[4] Sturtevant, Mills: Serum Sickness in a Series of 500 Patients Treated with Diphtheria Antitoxin, Arch. Int. Med., vol. xvii, No. 1.

[5] Gottleib and Oppenheimer: Active Immunization in Hay Fever, Biochemical Bull., New York, 1915, No. 4, p. 127.

Another source of attack (and one with which I have been working) is due to the presence of bacteria, primarily Streptococcus viridans or Streptococcus hemolyticus, secondarily Micrococcus catarrhalis.[6] These cases are obviously infective, and the more asthma I see the larger I think this group is; they occur with bronchitis, and sometimes run an acute course with febrile reaction, increase in pulse rate, cough, and sputum, and are often followed by emphysema.

If the sputum be collected in a sterile cup or Petri dish, washed, and a loop stirred in blood agar and poured in a Petri dish, and later streaked on North's medium, streptococcus can practically always be grown. Whatever the variety of germ, whether Streptococcus viridans or Streptococcus hemolyticus, an autogenous vaccine will cure the attacks. It is best given twice a week, in constantly increasing strength, for twelve to twenty injections. It is much better to give such dosage that local reaction occurs, although I have had cures in patients who showed no local reaction. On the other hand I have had cases which showed no improvement until doses were given in sufficient quantity to cause local reaction. I have adopted the practice of beginning with 100,000,000 in adults and feeling my way cautiously until finding the dose that caused local reaction, and then provoking a local reaction on every injection. If at any time the local reaction be too severe, or if general symptoms occur in the form of fever, chilliness, general malaise or aches, or increase in the asthma, I allow a rest for a period before beginning again, using my judgment as to continuing the same dosage or dropping back to a smaller one; it is better to avoid going backward if possible. 1000 million is often far enough to carry them, although more obstinate cases may require 2000 million, and I have carried them to 3000 million and higher. It is very striking to see the asthma clear up after the first injection, as has happened in a number of my cases. The longest period of cure I have to report is two years. I have been struck with the fact that streptococcus seems to be the chief offender; one case which had very foul sputum, and who showed Bacillus Friedländer, had to leave town, so that I had no opportunity of vaccinating him. I have had no pneumococcus cases. Micrococcus catarrhalis, I am convinced, is usually a mouth infection in asthma. I do not find it often in sputum that is carefully washed, and when the specimen for culture is carefully selected. Vaccination by catarrhalis seems to have had very little action on the asthmatic attacks when mixed infection is present. Babcock reports excellent results in a case of mixed infection, in which he used a mixed vaccine of pneumococcus, streptococcus and an anaërobic bacillus.[7] After inoculation for a time at semiweekly intervals it is usually advisable to make the intervals weekly.

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[6] Allen, R. W.: Vaccine Therapy and Opsonic Treatment.

In analyzing the following cases several facts are striking.

1. Clearing up of the asthma after the first or second injection (Cases 2, 3, 4, 6, 12, 14).

2. Cases that progressively improved from the time vaccines were started (Cases 1, 9, 14, 15).

3. Cases that did well but had occasional short relapses (Case 5, much improved, but could not continue treatment); case 10.

4. Obstinate cases which were finally cured (case 7) or improved (case 8).

5. Unimproved, case 11 (tuberculosis).

6. Of the 16 cases, 12 were cured, 3 were improved, and only 1 unimproved (tuberculosis).

7. Twelve cases required from 9 to 16 injections, extending over a period of from four to eleven weeks. Two cases were given treatments of fifteen and seventeen weeks respectively.

I should advise always using the regular vaccine or tuberculin syringe divided into hundredths, as no accurate count can be made with the ordinary hypodermic syringe, especially when small volumes are given. The following cases will show the preparation and method of administration of the vaccine, and the result of treatment:

CASE I.—L. B. R., aged six years. December 18, 1914. The child has had various attacks of bronchitis associated with asthma since nine months of age; attacks coming on at intervals of a few weeks and lasting from two to four days, accompanied by cough, dyspnea, temperature, sleepless nights, and loss of weight; they were harassing to the child and a cause of much anxiety on the part of the parents. As treatment had but slight and temporary effect, a swab was made from the larynx during an attack, and Gram-positive cocci obtained, which were arranged in long chains; on blood agar these colonies were each surrounded by an area of hemolysis. Vaccines were prepared and administered as follows:

Dec.	18.	Streptococcus	hemolytic	5,000,000.	No reaction.		
	23.	"	"	10,000,000.	Temperature	100.6	
	30.	"	"	25,000,000.	"	100.4	improved.
Jan.	6.	"	"	50,000,000.	"	100.6	"
	13.	"	"	75,000,000.	"	100.0	"
	20.	"	"	100,000,000.	"	100.0	"
	28.	"	"	125,000,000.	"	100.0	"
Feb.	5.	"	"	150,000,000.	"	100.0	cured.
	10.	"	"	175,000,000.	"	100.4	"
	19.	"	"	200,000,000.	"	100.6	"
	24.	"	"	250,000,000.	"	100.4	"
Mar.	3.	"	"	300,000,000.	"	100.4	"
	9.	"	"	350,000,000.	"	100.4	"

Cured; at the present writing (February, 1916) the child has had no further attacks, and is perfectly well.

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[7] Journal of the American Medical Association, vol. lxiv, No. 26.

December, 1916. This patient has relapsed and is again under treatment.

Case II.—Charles Spanze, aged twenty-five years; Italian; fruit vendor February 15, 1915.

No alcoholic nor venereal history. For four months has had attacks of asthma, every three or four weeks, lasting two or three days each and interfering with sleep. He had two hemoptyses three months ago, has lost seven pounds, and has had a few night sweats. Physical examination reveals no positive signs of tuberculosis, but chest is filled with squeaking rales and gives the signs of emphysema. Sputum examination shows no tubercle bacilli; Gram stain shows positive cocci in the washed sputum, and poured sputum reveals Streptococcus viridans in blood agar; vaccines were made from this and administered as follows:

Feb. 15.	Streptococcus viridans.	50,000,000.	Slight local reaction. No asthma after this first injection.
18.	" "	100,000,000.	Slight local reaction.
21.	" "	300,000,000.	" " "
24.	" "	500,000,000.	" " "
27.	" "	600,000,000.	" " "
Mar. 3.	" "	700,000,000.	" " "
6.	" "	800,000,000.	" " "
9.	" "	900,000,000.	" " "
12.	" "	1,000,000,000.	" " "

On March 12 he was discharged cured, having gained four pounds. A letter from him five months later stated he had had no return of his asthma.

On October 5, seven months after discharge, he was back complaining of cough, slight difficulty in breathing, but no distinct asthma. Sputum was again examined; showed no tubercle bacilli; Gram-negative cocci, in pure culture, vaccines were again made and administered.

Oct. 22.	Micrococcus catarrhalis.	100,000,000.	Slight local reaction.
25.	" "	200,000,000.	" " "
29.	" "	300,000,000.	" " "
Nov. 2.	" "	400,000,000.	" " "
5.	" "	600,000,000.	" " "
9.	" "	800,000,000.	" " "

During these three weeks his attacks became more frequent and of greater severity, so that 500 million streptococci were added to the vaccine with the result of a severe local reaction, chilliness, and temperature 102°, but with a cessation of the asthma. Sputum was again ordered and cultured, when pure Streptococcus viridans were grown on blood agar, and vaccines prepared.

Nov. 12.	Micrococcus catarrhalis. Streptococcus viridans.	1,000,000,000. 500,000,000.	Intense local and general reactions; temperature 102°, chilliness; severe local reaction; no more asthma.
16.	Micrococcus catarrhalis. Streptococcus viridans.	1,200,000,000. 700,000,000.	
23.	Micrococcus catarrhalis. Streptococcus viridans.	1,300,000,000. 700,000,000.	Injections at weekly intervals. No asthma; marked local reactions.

No more catarrhalis were given, as they seemed to do no good when patient was getting them alone.

30.	Streptococcus viridans.	700,000,000.	No asthma; marked local reaction.
Dec. 7.	" "	800,000,000.	" " " " "
14.	" "	1,000,000,000.	" " " " "
21.	" "	2,000,000,000.	By mistake. " " "
Jan. 11.	" "	2,250,000,000.	No asthma; " " "
18.	" "	2,250,000,000.	" " " " "
25.	" "	2,200,000,000.	" " " " "

Discharged cured; has gained three pounds more. An urticarial eruption followed the last injection. Had he been put on viridans at the beginning instead of catarrhalis, I doubt if he would have had any return. One month later he had gained four pounds more, a gain of fifteen pounds since starting treatment and he felt perfectly well.

Case III.—L. Wilson, aged thirty-three years, conductor. April 1, 1915.

His mother has had asthma for forty years. He has no alcoholic nor venereal history.

His first attack of asthma was two months ago, lasting thirty hours, after which it disappeared for five weeks; since that time it has been fairly continuous, with choking and coughing in the morning and difficult breathing at night; the cough has been very harassing.

Physical examination shows an overacting heart, 104. Lungs give slight comparative dulness at the right apex, with slightly prolonged and high-pitched expiration; there are sibilant rales over all. Weight, 125 pounds.

Sputum shows many Gram-positive cocci, some in clumps and some in chains. No tubercle bacilli; sputum poured in blood agar gives Streptococcus viridans. Vaccines were given as follows:

Apr. 15.	Streptococcus viridans.	50,000,000.	Slight reaction.	
18.	" "	100,000,000.	" "	
21.	" "	200,000,000.	Moderate "	
24.	" "	300,000,000.	" "	
27.	" "	500,000,000.	" "	
30.	" "	700,000,000.	" "	
May 3.	" "	800,000,000.	" "	There was no return of the asthma after the first injection.
6.	" "	900,000,000.	" "	
9.	" "	1,000,000,000.	" "	

Discharged cured May 9, "feeling better than for the past two years;" weight 131 pounds, a gain of 13 pounds. In August of the same year he reported no return, and in February of the following year he reported continued cure.

Case IV.—Celia Jaffe, aged twenty-eight years, October 22, 1915.

This patient had attacks of asthma in childhood until fourteen years of age. It returned seven months ago at intervals of three or four days, lasting one or two nights each time. Cough only recently; no hemoptyses; no sweats; no loss of weight.

Physical examination shows a well-nourished woman, breathing labored, with scattered sibilant and sonorous rales.

Sputum shows many Gram-positive cocci, no tubercle bacilli. Blood agar shows Streptococcus viridans.

Oct. 30.	Streptococcus viridans.	200,000,000.	No local reaction.	
Nov. 4.	" "	400,000,000.	" " "	No asthma.
7.	" "	600,000,000.	" " "	" "
10.	" "	800,000,000.	" " "	" "
13.	" "	1,000,000,000.	Good " "	" "
16.	" "	1,100,000,000.	" " "	" "
20.	" "	1,300,000,000.	" " "	" "
24.	" "	1,300,000,000.	" " "	" "
27.	" "	1,300,000,000.	Several local and general reaction so none was given for two weeks.	
Dec. 11.	" "	1,300,000,000.		
21.	" "	1,500,000,000.	No asthma; severe itching of the skin, but nothing to be seen.	

Discharged cured December 21.

Case V.—James Burk, aged twenty-five years; sailor. November 5, 1915.

Not alcoholic. Eighteen months ago had cough and pain in the chest; mucopurulent sputum; could not work for three weeks; cough and sputum were worse in the morning; he lost 35 pounds, but is now gaining. While at sea he is well, but on shore his breathing is affected by bad weather, and he has wheezing and dyspnea.

Physical examination shows a well-built and well-nourished man, with hyper-resonant chest and with sibilant and sonorous rales; no localized signs.

Sputum shows Gram-positive and Gram-negative cocci; blood agar, Streptococcus viridans; no tubercle bacilli. Vaccines were given as follows:

Nov. 10	Streptococcus viridans.	100,000,000.	No reaction; no asthma.
13.	" "	200,000,000.	" " " "
16.	" "	300,000,000.	" " " "
20.	" "	500,000,000.	" " slight oppression.
23.	" "	800,000,000.	" "
27.	" "	1,200,000,000.	Severe attack with advent of severe easterly storm; no return of asthma. As he had to go to sea he was now discharged improved, "by his own statement feeling very much better;" the severe attack with the advent of the easterly storm was the only attack after injections were started.
30.	" "	1,500,000,000.	
Dec. 3.			

Case VI.—Meyer Grisham, aged twelve years, school. November 10, 1915.

For some months has had attacks at night, so that he had to sit up out of bed to breathe; attacks were at intervals of a few days.

Physical examination negative except for asthma.

Culture showed Gram-positive and Gram-negative cocci. Streptococcus viridans on blood agar. No tubercle bacilli. Vaccines as follows.

Nov. 13.	Streptococcus viridans.	100,000,000.	Severe local reaction.
	Micrococcus catarrhalis.	100,000,000.	
16.	Streptococcus viridans.	200,000,000.	" " " no asthma.
	Micrococcus catarrhalis.	200,000,000.	
20.	Streptococcus viridans.	300,000,000.	" " " " "
	Micrococcus catarrhalis.	300,000,000.	
27.	Streptococcus viridans.	400,000,000.	Moderate " " " "
30.	" "	500,000,000.	" " " " "
Dec. 3.	" "	600,000,000.	" " " " "
7.	" "	700,000,000.	Good " " " "
18.	" "	700,000,000.	Slight; weekly injections now.
21.	" "	800,000,000.	Good local reaction.
28.	" "	1,000,000,000.	

Discharged, December 28, cured; no attacks since treatment was begun.

Case VII.—Emma Wilson, aged sixty years; dressmaker. November 30, 1915.

Father died of tuberculosis; patient has one son who had asthma and who was cured by inoculation (see Case III). At the age of eighteen years patient had asthma and hay fever, which attacks recurred every year; twenty years ago she moved from the country to New York City, when the hay fever disappeared but the asthma continued, and increased to such an extent that attacks were at intervals of a few days. Upon returning to the country in the summer the hay fever would return. Asthma, however, has been nearly continuous for years.

Physical examination shows a well-nourished woman with scattered sibilant and sonorous rales and labored breathing.

Sputum gave no tubercle bacilli, but Gram-positive cocci in clumps, the isolated ones being in chains. On blood agar, streptococcus grew in pure cultures. Vaccines were given as follows:

Nov. 30.	Streptococcus viridans.	100,000,000.	No reaction; no improvement.
Dec. 4.	" "	300,000,000.	No reaction; bad asthma with storm.
7.	" "	500,000,000.	Slight reaction; improved, slight asthma.
11.	" "	750,000,000.	Slight reaction; still has asthma.
14.	" "	1,000,000,000.	Moderate reaction; improvement after this.
21.	Seven days.	1,250,000,000.	" " one attack since last.
28.	Seven "	1,500,000,000.	" " oppression but no real asthma.
Jan. 8.	Eleven "	1,500,000,000.	Moderate reaction; no asthma, feels better.
25.	Seventeen "	1,500,000,000.	" " well until two days ago, slight attack.
Feb. 1.	" "	1,500,000,000.	Moderate reaction; no asthma.
5.	" "	1,600,000,000.	" " " "
12.	" "	2,000,000,000.	" " " "
16.	" "	2,250,000,000.	" " " "
23.	" "	2,500,000,000.	" " " "

Discharged, cured, February 23.

This was a case of many years' standing and proved obstinate. Patient was irregular in her attendance, but after improvement began it was continuous, and was followed by complete cure.

Case VIII.—Nita Connolly, aged twenty-five years; colored; domestic. For two years has had attacks at biweekly intervals, oppressed breathing, with cough and expectoration.

Physical examination negative except for asthmatic breathing.

Sputum showed no tubercle bacilli; Gram-positive cocci which proved to be Streptococcus viridans on blood agar. Vaccines were given as follows:

Nov. 27.	Streptococcus viridans.	100,000,000.	Not autogenous.
Dec. 11.	" "	100,000,000.	" " improved.
21.	" "	250,000,000.	Autogenous; "
Jan. 3.	" "	300,000,000.	Good reaction.
8.	" "	500,000,000.	Good reaction; one attack.
15.	By mistake.	2,700,000,000.	Marked reaction; local and general; no asthma.
22.	"	1,700,000,000.	Marked reaction; no asthma.
Feb. 5.	"	1,700,000,000.	Moderate reaction; mild attack with grippe.
11.	"	2,000,000,000.	Not autogenous; no asthma.
15.	"	2,000,000,000.	No asthma.
22.	"	2,500,000,000.	No asthma.

This girl was irregular in attendance and obstinate in reaction, but was greatly improved.

Case IX.—Charles Clement, aged eight years, November 25, 1915. Cough and colds for one year; indisposition to play; no loss of weight; no hemoptyses; no sweats; never well. One year ago was seen by Dr. F. L. Keays, who diagnosed bronchopneumonia; but the signs of this cleared up. The child, however, has remained listless and half sick. Various consultations have been held upon him, with the result that no positive diagnosis of tuberculosis could be made, and no tubercle bacilli have been found in the sputum after repeated examinations. Recently he has complained of pain in the back, and examination revealed a dorsal kyphosis, with spasm and pain upon motion. Asthma has existed over the entire period, which greatly harasses him and interferes with sleep. I saw him in consultation December 1, and on examination he revealed the dorsal kyphosis and well-defined signs of cavity in his left upper lobe. I took this to be a bronchiectatic cavity following his bronchopneumonia. Sputum examination showed no tubercle bacilli, but a culture of Streptococcus viridans and Staphylococcus albus. I made a vaccine of this and sent it to Dr. Keays, who administered it as follows:

Dec.	5.	Streptococcus viridans.	35,000,000.	No reaction; no result.
		Staphylococcus albus.	35,000,000.	
	8.	Streptococcus viridans.	70,000,000.	
		Staphylococcus albus.	70,000,000.	" " " "
	12.	Streptococcus viridans.	140,000,000.	
		Staphylococcus albus.	140,000,000.	" " " "
	16.	Streptococcus viridans.	280,000,000.	
		Staphylococcus albus.	280,000,000.	Sleeps better; less asthma.
	19.	Streptococcus viridans.	560,000,000.	
		Staphylococcus albus.	560,000,000.	
	23.	Streptococcus viridans.	800,000,000.	Improved.
	26.	" "	1,200,000,000.	"
	30.	" "	1,500,000,000.	" slight local reaction.
Jan.	2.	" "	1,500,000,000.	" " " "
	6.	" "	1,500,000,000.	" " " "
	9.	" "	1,500,000,000.	" " " "
	13.	" "	1,500,000,000.	No asthma; sleeps well.
	16.	" "	1,800,000,000.	" " " "
	20.	" "	1,800,000,000.	" " " "
	27.	" "	1,800,000,000.	
Feb.	3.	" "	2,000,000,000.	

Entirely cured of asthma, sleeps all night and is very much more comfortable; of course he has his original condition, and Dr. Keays is inclined to think he has sarcoma of the lung. This boy was a very unpromising case, and I hesitated to undertake his cure, but he did remarkably well. I heard from him two months later, and he was still free from asthma.

CASE X.—J. S., aged twenty-one years. January 20, 1916.

Various attacks for a period of one year, coming on at intervals of two or three weeks at first, but latterly they have been continuous.

Physical examination shows only labored breathing, with whistling rales. Sputum shows no tubercle bacilli, but Streptococcus viridans and Micrococcus catarrhalis. Vaccines were given as follows:

Feb.	1.	Streptococcus viridans.	210,000,000.	Improved; no reaction.
	5.	" "	300,000,000.	" less cough.
	8.	" "	400,000,000.	" local reaction.
	12.	" "	800,000,000.	" marked local.
	15.	" "	1,000,000,000.	Bad attack with very cold weather.
	19.	" "	1,250,000,000.	Much better.
	24.	" "	2,250,000,000.	No asthma; moderate reaction.
Mar.	2.	" "	2,500,000,000.	" " " "

This boy reported great improvement. As he thought himself well he stopped coming, and I feel sure has had no return.

Case XI.—Nellie B., aged thirty years; housewife. November 30, 1915.

For years had cough; dyspnea; smothering, especially at night. During last pregnancy the attacks cleared up six months before confinement and appeared three weeks after.

Physical examination shows a pale thin woman whose lungs are filled with sibilant and sonorous rales; at the right apex are slight dulness and subcrepitant rales. Sputum shows no tubercle bacilli, but Streptococcus viridans in blood agar.

This woman was vaccinated for two months twice a week, and carried as high as 3100 million without the slightest benefit. She stopped coming of her own accord, so I had no chance of increasing the doses further.

The following cases are loaned me through the courtesy of Dr. T. W. Hastings.

Case XII.—Miss B. G. T., aged 41 years. June 13, 1914.

Had hay fever for fourteen years; asthmatic attacks, including horse asthma, with cough and expectoration. She was in Saranac in 1914, with supposed tuberculosis. Culture now made of the sputum, and Streptococcus viridans and Micrococcus albus isolated. Vaccines were given as follows:

Aug. 20.	Streptococcus viridans.	120,000,000.	Worse for three days following.
	Micrococcus albus.	60,000,000.	
25.	“ “	240,000,000.	No asthma.
	“ “	120,000,000.	
Sept. 1.	“ “	360,000,000.	Slight local reaction.
	“ “	180,000,000.	
8.	“ “	480,000,000.	No asthma.
	“ “	240,000,000.	
24.	“ “	600,000,000.	“
	“ “	300,000,000.	
Oct. 7.	“ “	720,000,000.	“
	“ “	360,000,000.	
18.	“ “	840,000,000.	“
	“ “	420,000,000.	
Nov. 1.	“ “	960,000,000.	“
	“ “	480,000,000.	
10.	“ “	1,200,000,000.	“
	“ “	600,000,000.	

Discharged, cured, November 10. No attacks after the second injection.

Case XIII.—Miss E. U., aged eighteen years; school. April 15, 1910.

For years had cough and wheezy breathing and real asthmatic attacks, especially at night; sputum culture showed Streptococcus and Micrococcus catarrhalis. Vaccines were given as follows:

Apr. 30.	Streptococcus pyogenes.	66,000,000.	Mild local reaction.
	Micrococcus catarrhalis.	60,000,000.	No reaction; no asthma.
May 10.	“ “	132,000,000.	No asthma.
	“ “	132,000,000.	
18.	“ “	165,000,000.	“ “
	“ “	165,000,000.	
26.	“ “	165,000,000.	“ “
	“ “	165,000,000.	
31.	“ “	225,000,000.	Moderate local reaction.
	“ “	225,000,000.	No asthma.
Jan. 4.	“ “	225,000,000.	“ “
	“ “	225,000,000.	
10.	“ “	330,000,000.	“ “
	“ “	330,000,000.	

Discharged, cured, January 10. No attacks since treatment started.

CASE XIV.—Mrs. O. H. February 11, 1915.

A sufferer from asthma for years; no tuberculous element present. Sputum showed Gram-positive and negative cocci; no tubercle bacilli present. Vaccines were administered as follows:

Mar. 18.	Streptococcus viridans.	100,000,000.	
	Micrococcus catarrhalis.	50,000,000.	
22.	" "	200,000,000.	
	" "	100,000,000.	
26.	" "	300,000,000.	
	" "	150,000,000.	
30.	" "	400,000,000.	No local but slight local reaction.
	" "	200,000,000.	
Apr. 3.	" "	500,000,000.	" " " " "
	" "	250,000,000.	
7.	" "	600,000,000.	" " " " "
	" "	300,000,000.	
11.	" "	700,000,000.	" " " " "
	" "	350,000,000.	
15.	" "	800,000,000.	" " " " "
	" "	400,000,000.	
19.	" "	900,000,000.	" " " " "
	" "	450,000,000.	
23.	" "	1,000,000,000.	Slight local; no asthma.
	" "	500,000,000.	
28.	" "	800,000,000.	" " "
	" "	400,000,000.	
May 2.	Streptococcus viridans.	1,000,000,000.	
	Micrococcus catarrhalis.	500,000,000.	
6.	" "	1,200,000,000.	Severe local reaction.
	" "	600,000,000.	
10.	" "	1,400,000,000.	" " "
	" "	700,000,000.	
17.	" "	1,600,000,000.	" " "
	" "	800,000,000.	
24.	" "	1,800,000,000.	Marked " "
	" "	900,000,000.	
June 1.	" "	1,800,000,000.	" " "
	" "	900,000,000.	
8.	" "	2,000,000,000.	Slight " "
	" "	1,000,000,000.	
15.	" "	2,200,000,000.	
	" "	1,100,000,000.	
22.	" "	1,600,000,000.	
	" "	800,000,000.	
30.	" "	2,000,000,000.	
	" "	1,000,000,000.	
July 8.	" "	2,400,000,000.	
	" "	1,200,000,000.	
16.	" "	2,800,000,000.	
	" "	1,400,000,000.	
23.	" "	3,200,000,000.	
	" "	1,600,000,000.	
30.	" "	3,600,000,000.	
	" "	1,800,000,000.	
Aug. 6.	" "	4,000,000,000.	
	" "	2,000,000,000.	
13.	" "	4,400,000,000.	
	" "	2,200,000,000.	
20.	" "	4,800,000,000.	
	" "	2,400,000,000.	
27.	" "	5,200,000,000.	
	" "	2,600,000,000.	

There was only one attack of asthma since beginning treatment. Injections were followed within a few hours by very mild attacks, but were of no consequence and of only focal character. She reports great improvement and feels better than she has felt for years. Cured.

CASE XV.—Lieut. B., U. S. A., aged twenty-nine years. January, 1910.

Ever since childhood has had attacks of bronchitis and asthma. In 1907 he had an operation on his turbinates, with vaccines, and was cured. For the past two weeks he has had shortness of breath at night, but no true asthma. Physical examination shows sibilant and sonorous breathing, but no local signs. Sputum was cultured and vaccines made of equal parts of Streptococcus hemolyticus and Micrococcus catarrhalis.

Jan. 14.	Streptococcus hemolyticus and Micrococcus catarrhalis.	27,000,000 each.
18.	“ “ “ “	54,000,000 “
21.	“ “ “ “	81,000,000 “
25.	“ “ “ “	108,000,000 “
28.	“ “ “ “	135,000,000 “
Feb. 1.	“ “ “ “	162,000,000 “
8.	“ “ “ “	198,000,000 “
15.	“ “ “ “	216,000,000 “ weekly intervals.
25.	“ “ “ “	243,000,000 each ten day intervals.
Mar. 7.	“ “ “ “	270,000,000 each.

The following case does not belong strictly to this class, but I enter it as a matter of interest as belonging to a spasmodic group like asthma.

CASE XVI.—P. L. C., aged eleven years; school. October 30, 1914.

Has always been subject to attacks of coryza and sore throat accompanied by spasmodic laryngitis. Tonsillectomy five years ago with only moderate results. He lost fifty-five days' schooling the past year, owing to frequent colds. Recently had a severe coryza and bronchitis, with spasmodic cough. Physical examination was negative. Sputum cultured. Streptococcus viridans and Micrococcus albus grown; no tubercle bacilli found. Vaccines were given as follows:

Nov. 23.	Streptococcus viridans.	25,000,000.	
	Micrococcus catarrhalis.	10,000,000.	
Dec. 2.	“ “	37,000,000.	Local for twenty-four hours.
	“ “	15,000,000.	
14.	“ “	50,000,000.	
	“ “	20,000,000.	
18.	“ “	62,000,000.	
	“ “	25,000,000.	
21.	“ “	75,000,000.	
	“ “	30,000,000.	
Jan. 4.	“ “	100,000,000.	
	“ “	40,000,000.	
8.	“ “	125,000,000.	
	“ “	50,000,000.	
11.	“ “	150,000,000.	No reaction.
	“ “	60,000,000.	
18.	“ “	250,000,000.	
	“ “	100,000,000.	
22.	“ “	300,000,000.	
	“ “	150,000,000.	
27.	“ “	350,000,000.	
	“ “	175,000,000.	
Feb. 1.	“ “	400,000,000.	
	“ “	200,000,000.	
8.	“ “	400,000,000.	
	“ “	200,000,000.	
15.	“ “	400,000,000.	Coryza for two weeks; no reaction.
	“ “	200,000,000.	
Mar. 1.	“ “	400,000,000.	
	“ “	200,000,000.	
8.	“ “	450,000,000.	
	“ “	225,000,000.	
18.	“ “	500,000,000.	
	“ “	250,000,000.	

Bronchitis much improved; there has been no return of the spasmodic laryngitis.

I wish to express my thanks to Dr. T. W. Hastings, for his kind assistance, also to Dr. W. C. Thro for many valuable suggestions.